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## **A Deep-Learning Parallel Processing Agglomerative Algorithm for the Identification of Distinct Seismic Regions in the Southern Hellenic Seismic Arc**

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The identification of distinct seismic regions and the extraction of features of theirs in relation to known underground fault mappings could provide most valuable information towards understanding the seismic clustering phenomenon, i.e. whether an earthquake occurring in a particular area can trigger another earthquake in the vicinity. This research paper works towards that direction and unveils the potential presence and extent of distinct seismic regions in the area of the Southern Hellenic Seismic Arc. To achieve that, a spatio-temporal clustering algorithm has been developed based on expert knowledge regarding the spatial and timely influence of an earthquake in its nearby vicinity using seismic data provided by the Geodynamics Institute of Athens, and is further supported by geological observations of underground faults' mappings beneath the addressed potentially distinct seismic regions. This is made possible thanks to advances in deep learning and graphics processing units' 3D technology that encompass parallel processing architectures, which comprise of blocks of multiple cores with parallel threads providing the necessary foundation in terms of hardware for accelerated processing for parallel seismic big data analysis. Seismic data are normally stored in massive continuously expanding matrices, as wide areas seismic covering is thickening, due to the establishment of denser recording networks, and decades of data are being stacked together. This research work embodies that technology for the development and implementation of a Cuda parallel processing agglomerative spatio-temporal clustering algorithm that enables the import of expert knowledge for the investigation of the potential presence of distinct seismic regions in the vicinity under investigation. The overall spatio temporal clustering results are also in accordance with empirical observations reported in the literature throughout the vicinity of the Hellenic Seismic Arc.

Indexing terms: parallel processing, heterogeneous parallel programming, Cuda, distinct seismic regions, seismic clustering, spatio-temporal clustering

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